LA RANGE

Continuously Variable Power Supplies

Instruction Manual

coutant
electronics ltd

LA SERIES

Continuously Variable Power Supplies

Instruction Manual

coutant
electronics ltd

ELECTROTECH INSTRUMENTS DIVISION

CONTENTS

	Page
Introduction.....	1
Specification.....	1 & 2
Operating Instructions.....	4
Input Connections.....	4
Constant Voltage Operation.....	4
Constant Current Operation.....	5
Circuit Description.....	5 & 6
Parts list - P.C.B.	7 & 8
Parts list - Framework.....	8,9,10 & 11

ILLUSTRATIONS

Fig. 1. Primary Tap Connections.....	3
Components Diagram.....	12
Printed Circuit Board Layout.....	13
Circuit Diagram.....	Inside Back Cover.

Introduction

L.2. Series Power Supplies provide a continuously variable, highly stable output in both constant current and constant voltage modes.

Voltage and current levels are accurately set by multiturn potentiometers and continuously monitored on separate moving coil meters.

Units may be worked in series in the constant voltage mode and in parallel in the current mode and into any type of load.

SPECIFICATION

Constant Voltage Mode

Line Regulation:
(±10% mains change)
0.01% + 1mV

Load Regulation:
0.03% + 3mV

Ripple Voltage:
0.005% + 0.5mV peak to peak.

Transient Response:
Less than 10μS for recovery to within 10mV of steady state voltage after application of full load.

Temperature Range:
+10°C to +45°C

Temperature Coefficient:
Less than 0.02%/°C.

Constant Current Mode

Line Regulation:
(±10% mains change)
0.01% + 1mA

Load Regulation:
0.03% + 3mA

Ripple Current:
0.01% + 1mA peak to peak.

Polarity:
Output is fully floating. Either terminal may be grounded.

Input Voltage:
105V, 115V, 125V, 220V, 230V & 240V ±10% at 45 - 400c/s.

Input Lead:
3 - core flying lead.

Type	Voltage Range	Max. Current	Fuse	H	W	L	Weight
LA100.2	0-50	1 amp	1A	$8\frac{1}{2}$ 216mm.	5 5/8 143mm.	$9\frac{1}{2}$ 242mm.	12 lbs 5-5Kg.
LA200.2	0-30	2 amp	1A				
LA400.2	0-15	4 amp	2A				

Operating Instructions

Before switching input power to the unit check that:-

1. The A.C. fuse is correctly rated and is an anti-surge device.

2. The transformer primary taps are set to within $\pm$ 10% of the nominal. The unit is set to 230 volts before despatch unless otherwise specified by the customer.

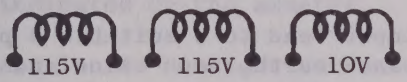
   The primary of the transformer is arranged as two 115 volt windings and a 10 volt winding to which soldered connections are made. The two 115 volt windings are connected in series for voltages 220 - 240 and in parallel for voltages 105 - 125, the 10 volt winding being connected in phase or anti-phase to add or subtract 10 volts. See Fig.1.

   Access is gained to the transformer by removing the four feet of the unit, loosening the 4 front panel retaining screws and removing the cover.

Fig.1.

Transformer Primary Tap Connections

The primary is arranged as three windings:-

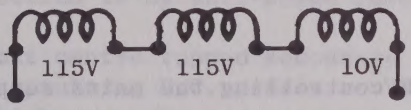


The 115V windings are connected in series for input voltages of 220 - 240V and in parallel for voltages of 105 - 140V.
The 10 volt winding is connected in series in phase or anti-phase to add or subtract 10 volts.

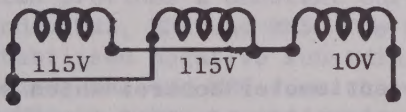
Examples:

10 volts connected in phase.

240V A.C. input

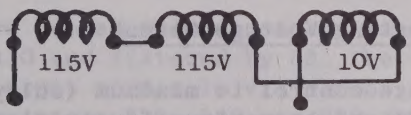


125V A.C. input

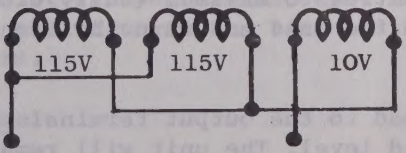


10 volts connected in anti-phase.

220V A.C. input



105V A.C. input



IMPORTANT

A dial is provided on the rear panel to indicate the voltage at which the unit is set. Be sure to re-set the dial if it becomes necessary to alter the input voltage taps.

NOTE: Some L.2 units have a rear panel switch which selects input voltages of 220 - 240 volts ± 10% and those units do not require transformer tap changes.

Input Connections

Connect the flying input lead to a suitable 3 pin plug using the colour code, green - earth, red - line and black-neutral.

Controls

Three main controls are provided.

Volts

A multiturn potentiometer control which sets the output voltage, the level of which is shown on the top meter.

'On-Off'

A rotary switch controlling the mains supply to the unit.

'Amps'

A multiturn potentiometer control which sets the current level at which the unit will enter into constant current operation. The current level is indicated on the bottom meter.

Operation: Constant Voltage Output

Turn the voltage control to minimum (fully anti-clockwise) and the current control to maximum (fully clockwise). Connect input power to the unit and turn the front panel rotary switch to 'On'.

Connect the load to the output terminals and adjust the voltage to the required level. The unit will remain in constant voltage operation unless the load resistance is so reduced that the current demand exceeds the capacity of the unit. The output will then enter into the constant current mode and the voltage will fall to maintain a constant current output.

Constant Current Operation

Turn the voltage control to maximum (fully clockwise) and the current control to minimum (fully anti-clockwise). Connect the load and adjust the current control until the required current level is indicated on the ammeter.

The unit will remain in the constant current mode until the load resistance is so increased that the current demand is less than the level set by the 'Amps' control; the unit will then change to constant voltage operation.

Circuit Description

Single phase mains input is switched by S1 to the primary windings of the transformer which are connected in series for input voltages of 230V - 240V and in parallel for voltages of 115 - 125V. Input protection is by anti-surge fuse FS1.

The output of the 22 volt centre tapped secondary is rectified by MR7 and MR8 and the resulting D.C. passes to VT6 and associated circuitry which provides a constant current output fed into three zener diodes MR3, MR4 and MR5. The most negative zener (MR3) forms the stabilised negative subsidiary rail line. The two more positive zeners MR4 and MR5 form the positive line. The junction of MR3 and MR5 is taken to the common reference rail which is also the positive output line.

The output of the centre tapped main secondary winding is rectified by MR9 and MR10 and filtered by C5. The resulting D.C. is passed to the output terminals via series transistors VT10, VT11, VT12 and resistors R28, R29 and R30. The resistors compensate for possible variation in the base-emitter voltages of the series transistors.

Constant Voltage Circuit

Zener diode MR1 is connected via R3 to the positive subsidiary rail to provide the reference voltage from which a reference current is derived by R1. This current is compared by long tailed pair comparator VT1 and VT2 with a current derived from the output by RV3.

Constant Voltage Circuit Cont'd.

Since the current in RV3 is proportional to the output voltage, the setting of this resistor determines the output voltage of the unit. The single ended output from the comparator is taken to common emitter amplifier VT6, the emitter of which is connected to the junction of MR4 and MR5. An approximate constant voltage is applied across R4 which defines the current in VT1. The output of VT3 provides the drive to emitter follower chain VT7 and VT9 which in turn controls the drive current to the base of the series transistors.

When the demand for current from the unit is increased, the output voltage tends to fall, reducing the voltage at the base of VT1. VT1 passes more current and hence VT6 allows more current to pass to the base of the emitter follower chain. The output current thus increases until the correct voltage is maintained at the output terminals.

Lag networks C1, R9, R14 and C2 ensure high frequency stability of the closed loop. C7 provides a degree of ripple attenuation.

Constant Current Circuit

Load current is monitored as the voltage drop across R31 which is in series with the regulator transistors. MR3 (which also defines the negative subsidiary rail voltage) provides the reference voltage for constant current operation. Potential divider R8 and RV4 derives a voltage from the voltage drop across R31 which is compared with the reference voltage by comparator VT3 and VT4. When the voltage across R31 increases to a point determained by the setting of RV4, the comparator is unbalanced in a direction to cause VT5 to divert drive current from the emitter follower chain, allowing the output voltage to fall. This circuit now assumes overriding control and the supply is in constant current operation.

Printed Circuit Board Parts List.

Resistors (± 5% ½W Carbon unless otherwise stated)

R1	2K	LA100		
	1.5K	LA200		
	1.5K	LA400		
R2	470Ω			
R3	240Ω	2%	½W	High Stab.
R4	4.7K			
R5	4.7K			
R6	2.2K			
R7	470Ω			
R8	4.3K	2%	½W	High Stab.
R9	1K			
R10	5.6K			
R11	5.6K			
R12	2.2K			
R13	470Ω			
R14	3K			
R15	180Ω			
R17	4.3K			
R18	560Ω			
R19	10K			
R20	6.2K			
R21	100Ω			
R22	2.2K			
R23	10Ω			
R24	1K	LA400 100Ω		
R25	1K			
R26	Selected in test, usually O/C			

Capacitors

C1	0.01µF	160V	Wima Tropyfol F
C2	1000pF	160V	Wima Tropyfol F
C3	200µF	35V	Wima Printilyt

Diodes

MR1	zener	5.1V	BCY88C5V1	Mullard
MR2	1N4001		Motorola	
MR3	zener	5.1V	BCY88C5V1	Mullard
MR4	zener	4.3V	BCY88C4V3	Mullard
MR5	zener	5.6V	BCY88C5V6	Mullard

Printed Circuit Board Parts List

Diodes Cont'd.

MR6	zener	4.3V	BCY88C4V3	Mullard
MR7	1N4001		Motorola	
MR8	1N4001		Motorola	

Transistors

VT1	ME4102	Microelectronics
VT2	ME4102	Microelectronics
VT3	ME4102	Microelectronics
VT4	ME4102	Microelectronics
VT5	ME4102	Microelectronics
VT6	ME0413	Microelectronics
VT7	MA8002	Microelectronics
VT8	BFY51	Mullard

Framework Parts List

Resistors

LA100.2

R28	1Ω	5%	5W	W/W
R29	1Ω	5%	5W	W/W
R30	1Ω	5%	5W	W/W
R31	1Ω	5%	5W	W/W
RV3	20K		Colvern CLR2405/125	
RV4	1K		Colvern CLR2405/125	

LA200.2

R28	½Ω	5%	5W	W/W
R29	½Ω	5%	5W	W/W
R30	½Ω	5%	5W	W/W
R31	½Ω	5%	5W	W/W
RV3	10K		Colvern CLR2405/125	
RV4	1K		Colvern CLR2405/125	

LA400.2

R28	(2x½Ω) ¼Ω	5%	5W	W/W
R29	½Ω	5%	5W	W/W
R30	½Ω	5%	5W	W/W

Framework Parts List

Resistors Cont'd.

LA400.2

R31	(2x$\frac{1}{2}\Omega$)	$\frac{1}{4}\Omega$	5%	5W	W/W
RV3		5K		Colvern	CLR2405/125
RV4		1K		Colvern	CLR2405/125

Capacitors

	C4	0.22μF	400V	Wima Tropyfol F
LA100.2				
	C5	1800μF	100V	32D182F 100BC6B
	C6	150μF	70V	Plessey CE1762/413
	C7	0.47μF	160V	Wima Tropyfol M
LA200.2				
	C5	5800μF	50V	32D582GO 50BC6B
	C6	500μF	35V	Plessey CE1745/424
	C7	0.47μF	160V	Wima Tropyfol M
LA400.2				
	C5	7300μF	40V	32D732GO 40BC6B
	C6	500μF	35V	Plessey CE1745/424
	C7	0.47μF	160V	Wima Tropyfol M

Diodes

LA100.2

MR9	1N4003	Motorola
MR10	1N4003	Motorola
MR11	1N4721	Motorola
MR12	1N4003	Motorola

LA200.2

MR9	1N4721	Motorola
MR10	1N4721	Motorola
MR11	1N4721	Motorola
MR12	1N4003	Motorola

LA400.2

MR9	1N4721	Motorola
MR10	1N4721	Motorola
MR11	1N4721	Motorola
MR12	1N4003	Motorola

Framework Parts List Cont'd.

Transistors

LA100.2			
	VT9	2N4347	R.C.A.
	VT10	2N4347	R.C.A.
	VT11	2N4347	R.C.A.
	VT12	2N4347	R.C.A.
LA200.2			
	VT9	2N3055	R.C.A.
	VT10	2N3055	R.C.A.
	VT11	2N3055	R.C.A.
	VT12	2N3055	R.C.A.
LA400.2			
	VT9	2N3055	R.C.A.
	VT10	2N3055	R.C.A.
	VT11	2N3055	R.C.A.
	VT12	2N3055	R.C.A.

Switches

	S1	S256	Bulgin

Fuse

	FS1	1 Amp	TDC123	Beswick

Transformers

LA100.2		
	T78/28	Albion
LA200.2		
	T78/27	Albion
LA400.2		
	T78/26	Albion

Terminals

	L1568/10B	Belling Lee

Framework Parts List Cont'd

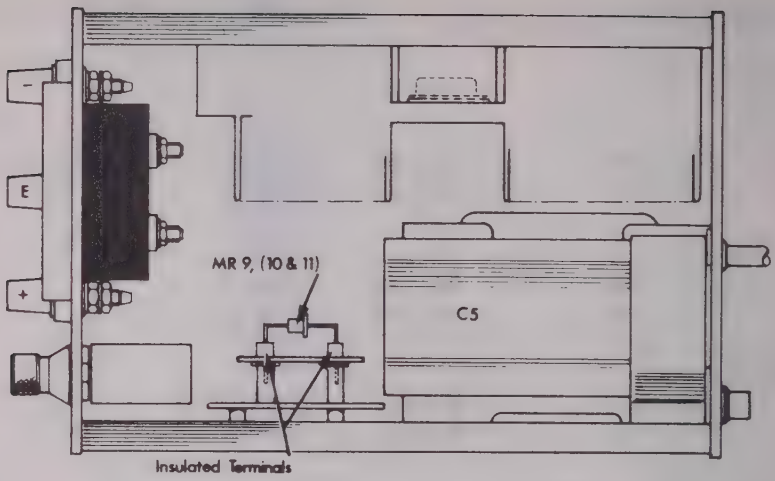
Meters

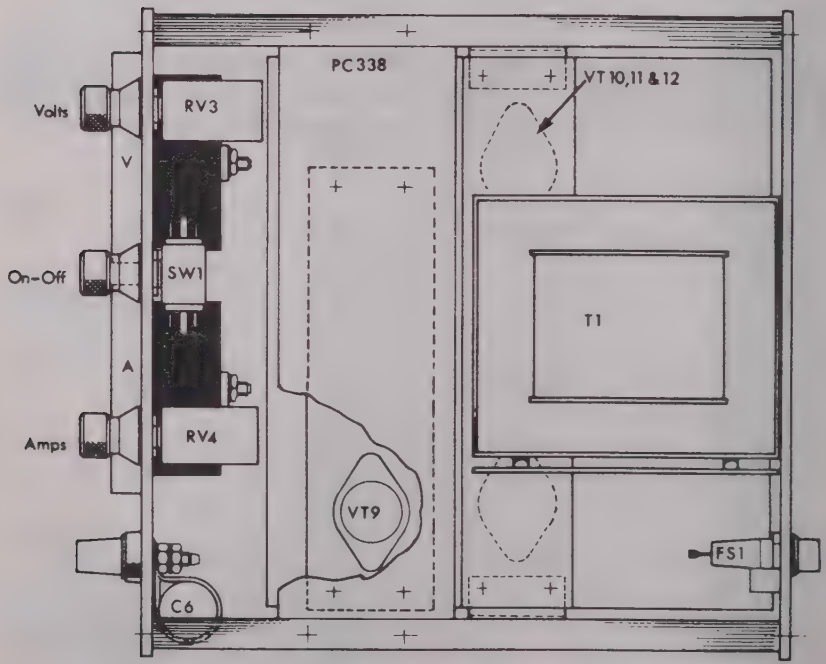
LA100.2				
	0 - 50V	Wilbac	Type A	or equivalent
	0 - 1A	Wilbac	Type A	" "
LA200.2				
	0 - 30V	Wilbac	Type A	" "
	0 - 2A	Wilbac	Type A	" "
LA400.2				
	0 - 15V	Wilbac	Type A	" "
	0 - 4A	Wilbac	Type A	" "

Printed Circuit Board

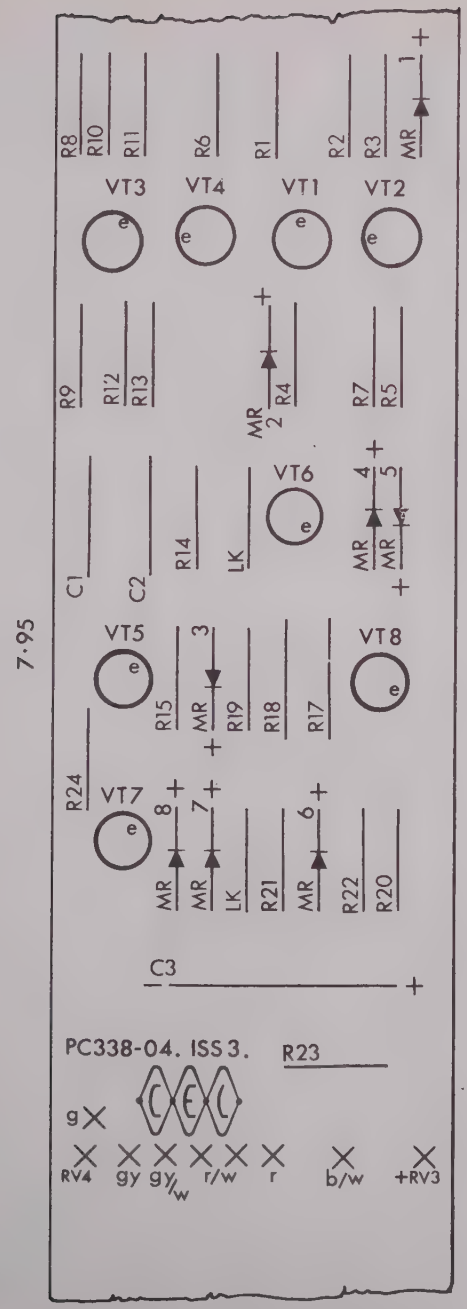
P.C. 338/00

Although every effort is made to ensure component list accuracy, continuous development in design may result in component changes and in some cases direct equivalent components may be used.

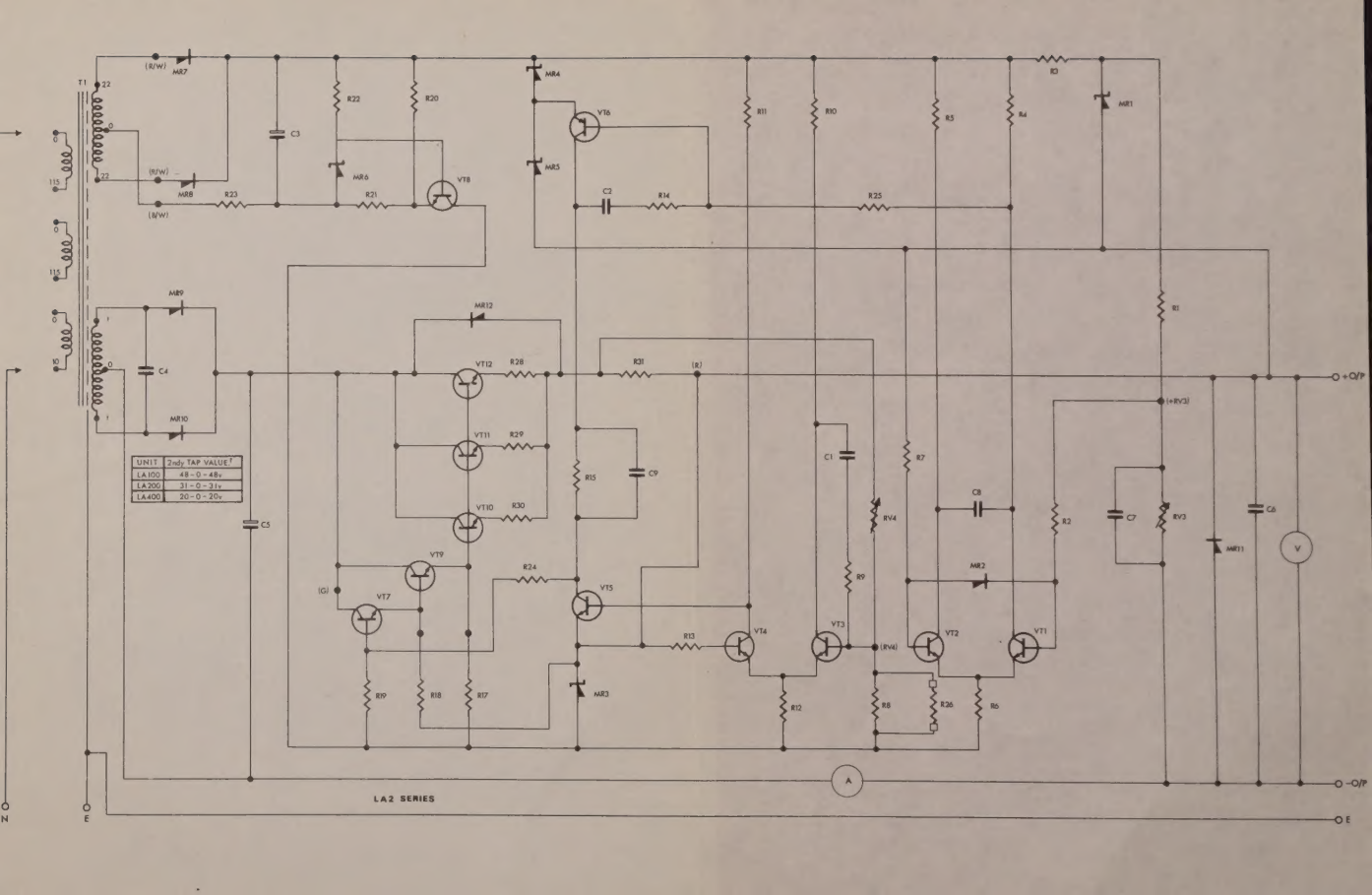




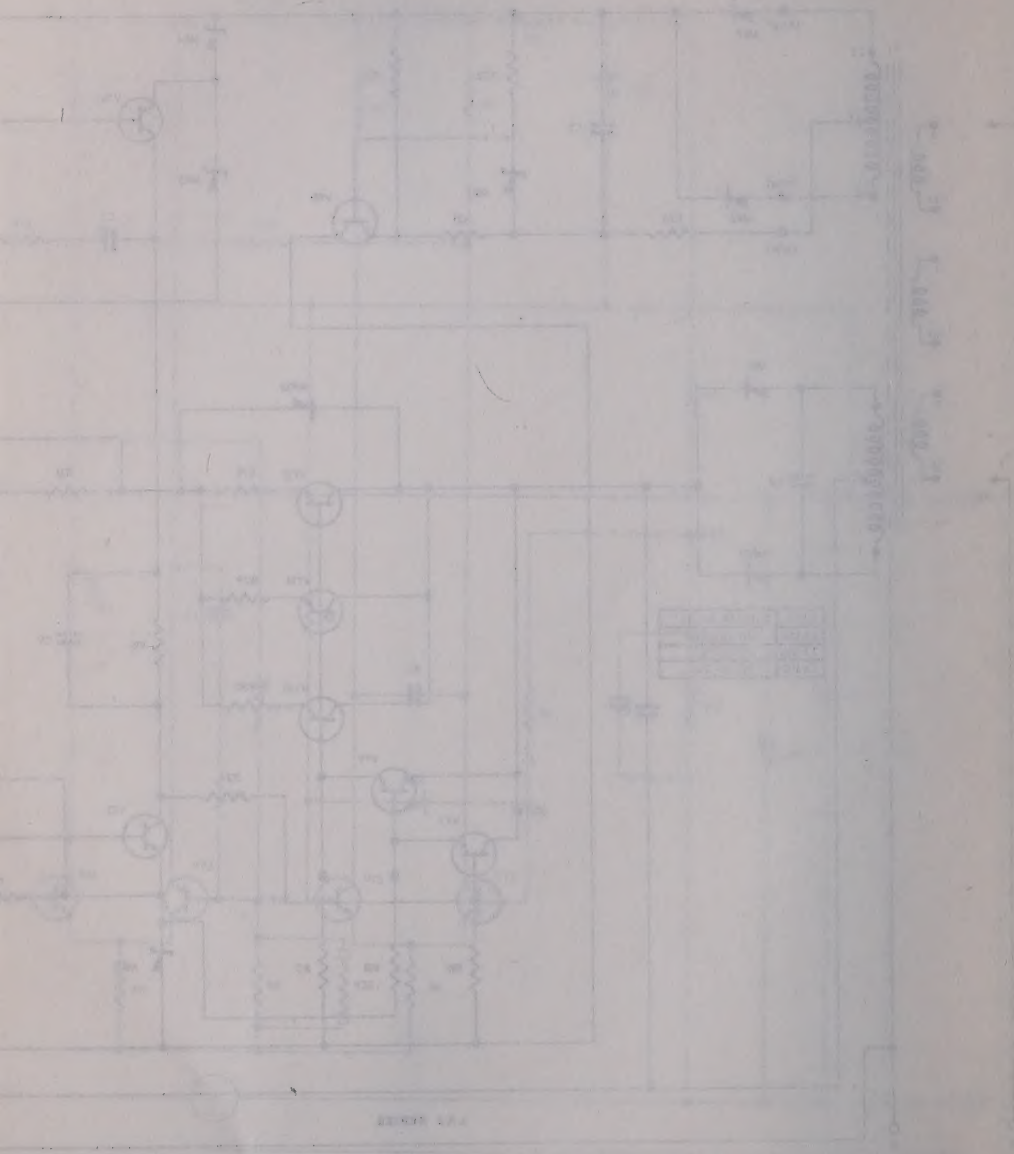
COMPONENT DIAGRAM



Printed Circuit Board



UNIT	2nd TAP VALUE†
LA100	48 - 0 - 48v
LA200	31 - 0 - 31v
LA400	20 - 0 - 20v



3 TRAFFORD ROAD·READING·BERKSHIRE·TEL:READING 55391